

That which is claimed is:

1. A method for protecting a zinc surface of a metal artifact, which comprises:

passivating the surface with an acid passivating solution; or activating the surface with an acid activating solution;

applying to the surface an aqueous priming solution of an alkali metal permanganate in the presence of halide ion, said solution having a pH of about 1 to 8; and then further applying to the surface an aqueous sealing solution.

2. The method of claim 1 in which said sealing solution comprises a mixture of a lithium silicate and another alkali metal silicate in a concentration to provide from 5 to 20 wt. percent of SiO₂ to said sealing solution, with each of said lithium silicate and other alkali metal silicate providing at least 10 percent of the SiO₂ to the sealing solution.

3. The method of claim 1 in which said acidic passivating solution is used, which solution comprises a solution of nitric acid, oxalic acid, or a combination thereof.

4. The method of claim 1 in which the pH of the priming solution is about 1.5 to 5.

5. The claim of claim 1 in which said halide ion is chloride.

6. The method of claim 1 in which said alkali metal permanganate is potassium permanganate.

7. The method of claim 1 in which the passivating or activating solution, the priming solution, and the sealing solution are all applied to the metal artifact by sequential dipping.

8. The method of claim 1 in which said halide ion is provided to the priming solution in the form of a alkali metal chloride.

9. The method of claim 1 which is performed at a temperature of about 50-80° F.

10. The method of claim 1 in which said priming solution is heated to a temperature of 100°-180° F.

11. The method of claim 1 in which said priming solution is applied to the metal artifact by dipping the metal artifact into said solution for at least 5 seconds.

12. The method of claim 11 in which said priming solution is applied to the metal artifact by dipping for about 10 to 30 seconds.

13. The method of claim 1 in which said aqueous sealing solution comprises lithium polysilicate, potassium silicate, and about 0.2 to 0.5 gram per/liter of a molybdic acid promoter.

14. The method of claim 13 in which the metal artifact is dipped in the sealing solution for at least about one minute.

15. A method for protecting a zinc surface of a metal artifact, which comprises:

passivating the surface with an acid passivating solution or activating the surface with an acid activating solution;

applying to the surface an aqueous priming solution of an alkali metal permanganate, a soluble rare earth metal salt, and a soluble aluminum salt, said solution having a pH of about 1 to 6, adjusted with nitric acid.

16. The method of claim 15, further comprising the subsequent step of applying to the surface an aqueous sealing solution with comprises a lithium silicate and another alkali metal silicate in a concentration to provide from 5 to 20 wt. percent of SiO₂ to said sealing solution, with each of said lithium silicate and other alkali metal silicate providing at least 10 percent of the SiO₂ to the sealing solution.

17. The method of claim 16 in which a promoter is also added to the sealing solution.

18. The method of claim 15 in which the pH of the priming solution is essentially 1.5 to 5.

19. The method of claim 15 in which said aluminum salt is aluminum chloride.

20. The method of claim 15 in which the alkali metal permanganate is potassium permanganate.

21. The method of claim 15 in which the passivating or activating solution and the priming solution are all applied to the metal artifact by sequential dipping.

22. The method of claim 15, which is performed at a temperature of about 50-80° F.

23. The method of claim 15 in which said passivating solution comprises about 5 to 30 gm./liter of oxalic acid at a pH of about 1-3.

24. The method of claim 15 in which said priming solution is applied to the surface by dipping said metal artifact into the priming solution heated to a temperature of 100°-180° F for a period of about 10 to 30 seconds.

25. The method of claim 16 in which said aqueous sealing solution comprises lithium polysilicate, potassium silicate, and about 0.2 to 0.5 gm/liter of molybdic acid.

26. The method of claim 16 in which the metal artifact is dipped in the sealing solution for at least about one minute.
27. The method of claim 15 in which said rare earth metal is cerium.
28. The method of claim 15 in which said rare earth metal salt is cerium chloride or cerium sulphate.
29. The method of claim 1 in which said priming solution contains a soluble rare earth metal salt.
30. The method of claim 29 in which said rare earth metal is cerium.
31. A method for protecting a zinc surface of a metal artifact, which comprises:
 - passivating the surface with a solution comprising an oxidizing acid, or activating the surface with an acid activating solution;
 - applying to the surface an aqueous priming solution of an alkali metal permanganate and an alkali metal halide, said solution having a pH of about 1 to 6;
 - and then further applying to the surface an aqueous sealing solution of a lithium silicate, and a sodium or potassium silicate.
32. The method of claim 31 in which a promoter is also present in said sealing solution.
33. The method of claim 31 in which the alkali metal permanganate is potassium permanganate.
34. The method of claim 31 in which the solutions are all applied to the metal artifact by sequential dipping.

35. The method of claim 31 in which said aqueous sealing solution comprises a lithium silicate and another alkali metal silicate in a concentration to provide from 5 to 20 wt. percent of SiO₂ to said sealing solution, with each of said lithium silicate and other alkali metal silicate providing at least 10 percent of the SiO₂ to the sealing solution, and about 0.2 to 0.5 gram per liter of molybdic acid.

36. The method of claim 1 in which said acid passivating solution is used.

37. A metal artifact, made by the process of claim 1.

38. A metal artifact, made by the process of claim 16.

39. A metal artifact, made by the process of claim 31.

40. The method of claim 1 in which said artifact is thereafter postbaked at 250° to 400° F to achieve a glossy coating.